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Evaluation of Physicochemical properties of Oil extracted from cotton seed (*Gossypium hibiscus*) and Okra seed (*Abelmoschus esculentus)*

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Abstract

The nutritive and calorific values of seeds make them good sources of edible oils and fats diet. Many physical and chemical properties of fats and oils have been investigated. The experimental study evaluated the physical and chemical properties were analyzed on oil extracted from the cotton and Okra seeds and compared with those reported by the other researchers. **Methodology:** Cotton seed and Okra seed were pulverized using and electric blender and thereafter stored in polythen bag in a refrigerator. The oil was extracted from the resulting powder by entailed using soxhlet apparatus to extract with petroleum spirit of boiling point between 40-60^{o}C. 200g of the ground Cotton seed and Okra seeds were packed in muslin cloth and inserted into the soxhlet extractor and petroleum spirit was used as the extracting solvent for a period of eight hours. The extracted oil samples were evaluated for physical and chemical properties. The result were represented as means and standard deviations. **Result** The Okra and cotton seeds have percentage oil contents of 20.43±0.90% and 22.37±0.38%, density of 8.6±0.1 and 8.30±0.1, moisture content of 85.6±1.0 and 84.00±1.0 and specific gravity of 0.84±0.05 and 0.96±0.02 g/cm3 respectively. The chemical analysis carried out on the oil of okra and cotton seeds have the following properties: acid value of 0.5±0.1 and 0.45±0.02 mg KOH/g, saponification value of 162.7±0.50 and 185.00±1.0 mg KOH/g, iodine value of 5.94±0.1 and 5.64±0.05, peroxide value of 12.0±1.0 and 2.40±3.12meq KOH/g and unsaponifiable matter 17.20±1.0 and 20.00± 0 respectively. **Conclusion:**The low oil content of the seeds obtained in this study strongly indicates its prospects for commercial extraction. Overall

results suggest that the oil will be a good candidate for conventional oil and good raw material for soap, paint and food industries

Keywords: Abelmoschus esculentus, Peroxide value, Specific gravity, Soxhlet Extraction, oil.

Introduction

Fat and oils are of nutritional importance because they are one of the three major classes of food. Oils are used in a variety of ways. They are used for food texturing, baking, and frying and also used industrially, in the manufacture of soap, detergent, cosmetics and oil paints. In plants, oil is deposited in the seeds mostly in the endosperm along with carbohydrates where they jointly nourish the embryo. It is also found in some plants mesocarp e.g. in palm fruits. In animals, oil is found in various parts of the body e.g. liver. Nutritional and industrial processes have increased the demands for oils and this in turn has led to the search for oils from different types of seeds (Birnin-Yauri and Garba 2011).Cotton belongs to genus Gossypium and Malvaceae family that grows naturally as a perennial, but for commercial purposes is grown as an annual crop (Wakelyn & Wan, 2003). Cotton is a major crop in the world (Yu et al., 2012). Cotton fiber is a source of natural textile, and cottonseed is a source of oil for human consumption, cotton meal and minerals for livestock feed (Yu et al., 2012; He et al., 2013).Cotton seed oil is among the most unsaturated oils, others being safflower, corn, soybean, rapeseed and sunflower seed oils. Cotton seed oil performs better than other oil as it lasts a long time and stores well by withstanding higher temperature for food items due to its high antioxidant content (Sekhar & Rao, 2011). Okra fruit is majorly consumed fresh or cooked and is a major source of vitamins A, B, C, minerals, Iron and Iodine and important vegetable source of viscous fiber but it is reported to have low in sodium, saturated fat and cholesterol (Adeboye and Oputa, 1996; Kendall and Jenkins 2004). Presence of Fe, Zn, Mn and Ni also has been reported. The aim of this research is to evaluate the physicochemical properties of oil from cottonseed and Okra seed.

MATERIALS AND METHODS

Chemicals and reagents

All the chemical and reagents used in this study were of analytical grade were products of British Drug House Laboratory, England.

Cotton seed and Okra seed

The seed of cotton seed Okra were obtained from Ijebu-igbo Market in Ogun- State Nigeria.

Extraction of oil from seed.

The cotton seed and Okra seed were pulverized using and electric blender and thereafter stored in polythen bag in a refrigerator. The oil was extracted from the resulting powder by adopting the method describe by Association of Official Analytical Chemist, which entailed using soxhlet apparatus to extract with petroleum

spirit of boiling point between 40-60oC. 200g of the ground breadfruit seeds were packed in muslin cloth and inserted into the soxhlet extractor and petroleum spirit was used as the extracting solvent for a period of eight hours. At the end of this period, the solvent was recovered by rotary

Evaporator and residual oil was oven-dried at 75oC for one hour. The oil was then transferred to a desiccator and allowed to cool before being weighed. The drying, cooling and weighing was repeated until a constant dry weight was obtained. The extracted oil sample was sealed in dark brown coloured glass bottle and kept for analytical tests.

Determination of physicochemical properties of oil

The acid value, saponification value, iodine value, peroxide value and unsaponifiable matter were determined using the procedures described by Person (1981). The moisture content was determined by the procedure specified by Weiss .The density was determined by dividing the weight of the oil by its volume.

PROCEDURE

Specific gravity was determined using specific gravity bottle according to the method described by Pearson, 1981.

Iodine value (Wiji's method), saponification number, acid value, peroxide values were as recommended by the AOAC, 1984. For Iodine value of each sample 0.20g of oil was dissolved in 15 mL carbon tetrachloride in 100 mL glass stoppered flask. 25 mL of Wiji's solution was added, the flask stoppered and allowed to stand for 2 hours in the dark at 25°C 20 mL of 10% potassium iodide (KI) solution was added and mixture titrated with 0.2N sodium thiosulphate (Na S O) using starch indicator. A blank determination was carried out and the Iodine value calculated using the formula

$$\text{Iodine value} = \frac{12.69N\ (V - V\ )}{W}$$

Where N = Normality of thiosulphate

V1 = Volume (mL) of thiosulphate solution used in test.

V2 = Volume (in mL) of thiosulphate solution used in blank

W = Weight of sample (0.20g).

Saponification value of the oil samples were determined as described below: 1g of each oil was dissolved in 12.5 mL of 0.5% ethanolic KOH and the mixture refluxed for 30 minutes. 1 mL of phenolphthalein indicator was added and the hot soap solution titrated with 0.5N HCl. A blank determination was also carried out under the same condition and saponification value determined using the equation.

$$\text{Saponification value} = \frac{56.1N\ (V - V\ )}{W}$$

Where N = Normality of Hydrochloric acid used

V1 = Volume of Hydrochloric used in test

V = volume of Hydrochloric acid used in blank 2
W = Weight of oil used (1g)
For peroxide value (Pv), 1g of each oil sample was weighed into a 200 mL conical flask then 25 mL of 2:1 v/v glacial acetic acid chloroform solvent was added 1 mL of saturated potassium iodine was then added and mixture left in the dark for 1 minute. Next, 30 mL of water was added and the mixture titrated with 0.02N thiosulphate solution using 5 mL starch as indicator. A blank determination was similarly carried out.
Pv was calculated from the equation

$$\text{Peroxide value (PV)} = \frac{\{100\ (v1\text{-}v2)\ meg/kg\}}{W}$$

V = volume (mL) of thiosulphate used in test 1
V = volume (mL) of thiosulphate used in blank 2
N = Normality of thiosulphate (Na S 0) 2 2 3
Acid value was determined for each oil sample by dissolving 0.20g of each oil in 2.5 mL of 1:1 v/v ethanol: diethylether solvent and titrating with 0.1N sodium hydroxide while swirling using phenolphthalein as indicator. Calculation is as follows

$$\text{Acid value} = \frac{\{56.1\times N\times V\}}{W}$$

Where N = Normality of NaOH used
V = Volume (mL) of NaOH used
W = Weight of sample used
Statistical analysis: All extractions and analysis were performed in triplicates. Results were expressed in mean±S.D. statistical significance was established using Analysis of variance (ANOVA). Means were separated according to Duncans multiple rangeanalysis ($p<0.05$).

RESULT

Table 1: Some physical properties of the oil extracted from Okra and Cotton seed

S/N	Parameters	Okra	Cotton
1	Percentage yield	**20.43±0.90**	**22.37±0.38**
2	Colour Light	Pale ywllow	Yellow
3	Density	**8.6±0.1**	**8.30±0.1**
4	Moisture	**85.6±1.0**	**84.00**±1.**0**
5	Specific gravity (g/cm3)	**0.84±0.05**	**0.96±0.02**

Table 2: Chemical properties of the oil from extracted Okra and Cotton seed.

S/N	Parameters Values	Okra	Cotton
1	Acid value mg/g	**0.5±0.1**	**0.45±0.02**
2	Peroxide Value mEq/Kg	**12.0±1.0**	**2.40±3.12**
3	Iodine value mg/g	**5.94±0.1**	**5.64±0.05**

5	Saponification value mgKOH/g	**162.7±0.50**	**185.00±1.0**
6	Unsaponifiable matter g/kg	**17.20±1.0**	**20.00± 0**

The values are mean of three replicates

Discussion

Percentage yield of the oil from Cotton and Okra seed was 20.43±0.90 and 22.37±0.38 which is considered to be in range with the yield of oil from *Pentaclethra macrophylla* (20.80C±1.20) but higher than *Treculia Africana, Persea gratesima and Telferia occidentals reported by* Akubugwo et al., 2008. Therefore, the seed is classified as low oil yielding seed. The oil colour is light yellow which is in line with most oils which their colour are yellow-red or amber liquids. The colour is from the presence of chlorophylls and carotenoids (Emenonye and Nwabueze, **2016**). Table 2 gives the chemical properties of the seed oil. Acid value is an important index of cchemical property of oil which is used to indicate the quality, age, edibility and suitability of oil use in industries such as paint (Akubugwo et al., 2008). According to Demain, 2008, acid values are used to measure the extent to which glycerides in the oil has been decomposed by lipase and other physical factors such as light and heat. Thus, the acid value of the cotton and Okra seed oil suggests that the oil is less susceptible to lipase action. This value of 0.5±0.1 and 0.45±0.02mg/g is within the range compare to 0.6mg/g proposed by Usoro et al., 1982 for edible vegetable oils. The iodine value of oil from cotton seed and Okra seed is 5.94±0.1 and 5.64±0.05. This is an indication of relative high saturation in this oil and thus it become less vulnerable to oxidation. The iodine value of oil does not indicate the position of the double bonds or amount of olefinic carbon but rather provides an overall status of unsaturation of the oil, so it is not possible to point out the position of double bond(s) which are less susceptible to oxidation (Knothe and Dunn 2003). Thus this oil can be classified as semi drying oil. Peroxide value is used as a measure of extent to which rancidity reactions have occurred during storage. The higher peroxide value of cotton seed and Okra seed oil of 12.0±1.0 and 2.40±3.12 mEq/Kg indicated a less susceptibility to oxidation. Again, it falls outside the range of 1-10mEq/Kg stipulated for freshly prepared oil (Cooks and Reds, 1966). Peroxide value between 20 and 40 result to rancid taste (Akubugwo et al., 2008).

Saponification value is an index of average molecular mass of fatty acids in oil sample. The higher saponification value of Okra and cotton seed oil (162.7±0.50 and 185.00±1.0 mgKOH/g), suggest that the mean molecular weight of fatty acid or number of ester bond is high, thus the fat molecules were intact (Denniston et el., 2004). Therefore the higher saponification of the Okra and cotton seed oil will be highly useful in the saponification industry. In general, unsaponifiable matters are present in edible oils less than 2% (Bwai *et al*., 2013) which include tocophenols/tocotrienols, other phenolics, phytosterols, hydrocarbons, among others. The unsaponifiable matters of Okra and cotton seed oil is 17.20±1.0 and 20.00±0k/kg which is within the range of the edible oils.

Conclusion

This study showed that all the physicochemical properties of *Cotton and Okra* seed oil studied compared favourably with other conventional seed oils. Their colour and odour are agreeable. The seed oils therefore have potential for development for use as industrial oils.

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